



Integrated Water Treatment System (IWTS)

The Challenge

The Hanford Spent Nuclear Fuel (SNF) Project is preparing to move a large amount of metallic uranium SNF from the existing K Basin pools into dry storage. This fuel was originally irradiated in the Hanford N reactor and has been stored underwater for a number of years at a location near the Columbia River. The movement and packaging of the fuel will initially involve a number of underwater processes such as cleaning and sorting. During these processes, the accumulated loose product of years of fuel corrosion will be disturbed. Additionally, the processes themselves will create fresh particulate since the frequency and severity of remote handling operations will be significant. An uncontrolled cloud of particulate and soluble materials would have adverse consequences from the point of view of contamination spread, radiological dose to operators, and visibility in the underwater work zone. The challenge is that any device or series of devices designed to mitigate these effects, besides being effective at removing variously sized particles, must perform in a critically and radiologically safe manner and in a manner that does not accumulate hydrogen. Hydrogen gas potentially may be generated when newly created metal particulate comes in contact with water.



Some of the IWTS equipment components: Left – filter vessels, above – filtration booster pump skid

Current Approach

No movements of N reactor fuel have been attempted on the scale now planned for the near term in K Basins. This fuel consists of approximately 100,000 elements stored in stainless steel canisters. In the last several years, movements of smaller batches of fuel canisters and movements of over 200 fuel elements have occurred as part of the fuel and sludge characterization activity. Observations made when canisters are opened and observations made when fuel elements are moved have shown that the canisters do contain significant amounts of sludge and that the sludge will trail into the basin when elements are handled. Sampling of water contained in the canisters has demonstrated the presence of significant amounts of radionuclides and hydrogen which will be released to the basin during the anticipated processing. Chemical analysis of the sludge has shown the presence of many constituents including oxides of uranium and hydroxides of

Benefits and Features

- ◆ Traps soluble and particulate emissions
- ◆ Reduces the spread of contamination and improves water clarity
- ◆ Traps a variety of particle sizes
- ◆ Is compatible with the handling of reactive metal particles

aluminum and iron. Particle size determinations in the laboratory show a wide range of sizes and a wide range of settling times.

New Technology

The Integrated Water Treatment System (IWTS) has been installed to remove radionuclides and particulates from the K Basin water. The system is a four-stage water filtration system consisting of three submerged pumps, a knockout pot, ten settling tanks, three filtration modules and three ion exchange modules with associated structure and piping. The system has been deployed in the Hanford K-West Basin. Expected feed rate is 320 gallons per minute at a system pressure of 112 psi. Suspended solids entering the system are expected to be approximately 20.8 mg/l with a maximum of 375 mg/l.

The pumps suction material from the Fuel Retrieval System (FRS) with one pump dedicated to each of the major subsystems of FRS. The knockout pot (33 inches tall and 16 inches diameter) consists of 7 successive layers of baffle plates arranged at 30-degree angles. Particles smaller than 0.5 mm are expected to be trapped here.

Flow then proceeds to the settler tanks each 20 in. diameter and 192 in. length and a capacity of 1 cubic meter. The densest portion (50 percent) of the remaining particulate is expected to be removed at this step and is expected to include

any remaining metallic fuel particles. Hydrogen gas that may be generated flows back to the basin water and not to locations where combustible mixture with air is possible.

The remaining particles are then removed during a filtration step followed by a reduction of the soluble radionuclide content through the use of ion exchange modules. This technology will improve water clarity and trap most particulates in the water.

Information Contacts

R. W. Rasmussen, Duke Engineering and Services, Inc.
Spent Nuclear Fuel (509) 372-0021
B. J. Makenas, Fluor Daniel Hanford, Inc. (FDH)
(509) 376-5447
G. T. Frater, FDH Technology Management
(509) 372-4291
R. A. Wible, DOE-RL Science and Technology
Programs, (509) 372-4776

Technology Vendor

Chem Nuclear Systems, Inc.
140 Stoneridge Drive
Columbia, SC
(803) 758-1811



Funding for technology deployment was provided by the U.S. Department of Energy.

Fluor Daniel Hanford, Inc., Technology Management
TM-DEP-99-011
